Statement of Basis

Tier II Operating Permit No. T2-2019.0027
Project ID 62246

P4 Production LLC
Soda Springs, Idaho

Facility ID 029-00001

Final

September 26, 2019
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Permit Writer

D.P.

The purpose of this Statement of Basis is to satisfy the requirements of IDAPA 58.01.01.et seq, Rules for the Control of Air Pollution in Idaho, for issuing air permits.

ACRONYMS, UNITS, AND CHEMICAL NOMENCLATURE

AAC	acceptable ambient concentrations
AACC	acceptable ambient concentrations for carcinogens
acfm	actual cubic feet per minute
ASTM	American Society for Testing and Materials
BACT	Best Available Control Technology
BMP	best management practices
Btu	British thermal units
CAA	Clean Air Act
CAM	Compliance Assurance Monitoring
CAS No.	Chemical Abstracts Service registry number
CBP	concrete batch plant
CEMS	continuous emission monitoring systems
cfm	cubic feet per minute
CFR	Code of Federal Regulations
CI	compression ignition
CMS	continuous monitoring systems
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	CO_2 equivalent emissions
COMS	continuous opacity monitoring systems
DEQ	Department of Environmental Quality
dscf	dry standard cubic feet
EL	screening emission levels
EPA	U.S. Environmental Protection Agency
FEC	Facility Emissions Cap
GACT	Generally Available Control Technology
gph	gallons per hour
gpm	gallons per minute
gr	grains (1 lb = 7,000 grains)
HAP	hazardous air pollutants
HHV	higher heating value
Hg	Mercury
HMA	hot mix asphalt
hp	horsepower
hr/yr	hours per consecutive 12 calendar month period
ICE	internal combustion engines
IDAPA	a numbering designation for all administrative rules in Idaho promulgated in accordance with the Idaho Administrative Procedures Act
iwg	inches of water gauge
km	kilometers
lb/hr	pounds per hour
lb/qtr	pound per quarter
LCDA	Lime Concentrated Dual Alkali
m	meters
MACT	Maximum Achievable Control Technology
MBACT	Mercury Best Available Control Technology
mg/dscm	milligrams per dry standard cubic meter
MMBtu	million British thermal units
MMscf	million standard cubic feet
NAAQS	National Ambient Air Quality Standard
NESHAP	National Emission Standards for Hazardous Air Pollutants

NO_2	nitrogen dioxide
NO_X	nitrogen oxides
NSPS	New Source Performance Standards
O&M	operation and maintenance
O_2	oxygen
PAH	polyaromatic hydrocarbons
PC	permit condition
PCB	polychlorinated biphenyl
PERF	Portable Equipment Relocation Form
PM	particulate matter
$PM_{2.5}$	particulate matter with an aerodynamic diameter less than or equal to a nominal 2.5 micrometers
PM_{10}	particulate matter with an aerodynamic diameter less than or equal to a nominal 10 micrometers
POM	polycyclic organic matter
ppm	parts per million
ppmw	parts per million by weight
PSD	Prevention of Significant Deterioration
psig	pounds per square inch gauge
PTC	permit to construct
PTC/T2	permit to construct and Tier II operating permit
PTE	potential to emit
PW	process weight rate
RBLC	RACT/BACT/LAER Clearinghouse
RAP	recycled asphalt pavement
RFO	reprocessed fuel oil
RICE	reciprocating internal combustion engines
Rules	*Rules for the Control of Air Pollution in Idaho*
scf	standard cubic feet
SCL	significant contribution limits
SIP	State Implementation Plan
SM	synthetic minor
SM80	synthetic minor facility with emissions greater than or equal to 80% of a major source threshold
SO_2	sulfur dioxide
SO_x	sulfur oxides
T/day	tons per calendar day
T/hr	tons per hour
T/yr	tons per consecutive 12 calendar month period
T2	Tier II operating permit
TAP	toxic air pollutants
TEQ	toxicity equivalent
T-RACT	Toxic Air Pollutant Reasonably Available Control Technology
ULSD	ultra-low sulfur diesel
U.S.C.	United States Code
VOC	volatile organic compounds
yd^3	cubic yards
$\mu g/m^3$	micrograms per cubic meter

FACILITY INFORMATION

Description

P4 Production, LLC (P4) owns and operates an elemental phosphorous production facility near Soda Springs, Idaho. The facility processes phosphate ore to produce elemental phosphorus (P_4) for sale. There are two primary departments at the Facility – the Burden Preparation Department and the Furnace Department.

The Burden Preparation Department includes activities associated with handling and beneficiation of raw materials (coke, quartzite, and phosphate ore) to produce a suitable feedstock for processing by the Furnace Department to produce elemental phosphorus. Ore is received and stockpiled onsite. Ore is then conveyed to a nodulizing kiln for processing. The resulting nodules are cooled and stockpiled or sent directly to the nodule sizing and scale room from the cooler. In the scale room the nodules are blended with coke and quartzite. The coke and quartzite are received and stockpiled separately at the Facility and are dried to a desired moisture content, if necessary, prior to blending with the nodules. The nodule-coke-quartzite blend (burden) is then sent to the Furnace Department for processing. Fuel used in the nodulizing kiln is primarily carbon monoxide (CO) off-gas from the furnace process which is supplemented with small quantities of natural gas and coal. The kiln off-gas is treated with existing air pollution control equipment including a series of dust bins, a spray tower, and four parallel hydrosonic venturi scrubbers. The hydrosonic venturi scrubbers are fed with lime concentrated dual alkali (LCDA) solution to scrub acid gases, primarily SO_2, from the gas flow.

The Furnace Department operations utilize electric arc furnaces to melt the burden, chemically react the components, and create off-gases containing elemental phosphorus. The burden enters one of three electric furnaces (No. 7, No. 8, and No. 9) that operate on a continuous basis at temperatures of 1,400 to 1,500°C (2,550 to 2,732°F). The reducing environment in the furnaces reacts phosphate from the nodules to form phosphorus gas, carbon monoxide gas, and molten slag and ferrophosphorus. The furnace gases, composed of mainly carbon monoxide and phosphorus, are drawn through electrostatic precipitator (ESP) dust collectors where particulate matter is removed. The cleaned gases are then sent through water spray condensers where the gases are cooled - condensing the phosphorus. The condensed phosphorus is pumped to settling/storage tanks for further solids removal and product storage. The stored phosphorus is loaded into water-blanketed railroad cars for shipment to market.

After the removal of phosphorus, the furnace off-gas is composed primarily of CO and water vapor. The CO is then sent to the nodulizing kiln as fuel. Excess CO is combusted in a thermal oxidizer (TO) unit and the resulting off-gases are treated with three parallel high energy venturi scrubbers.

The furnaces are periodically tapped to remove accumulated molten slag and ferrophosphorus. Slag taps occur about 45-48 times per day per furnace and last about 15 minutes per tap. The ferrophosphorus is tapped once or twice per day per furnace. The tapping gases pass through a high energy venturi scrubber equipped with an entrainment separator before discharge to the atmosphere.

The molten slag is tapped into cast steel ladles that are transported and poured onto the slag storage pile at the site. The ferrophosphorus is also collected in ladles, cooled, and stockpiled on-site.

P4's phosphate ore nodulizing kiln is regulated for particulate matter, radionuclides, SO_2, and mercury emissions. The cooler spray tower controls particulate matter and SO_2 emissions from the nodule cooler at the discharge end of the kiln. The kiln flue gas passes through a dust knockout chamber followed by a North spray tower. The flue gas is then split into four separate streams, each treated by a Hydro-Sonic venturi scrubber, a pair of parallel cyclonic separators, primary and secondary mist eliminators, and GMCS collectors before exiting through a stack. The lime concentrated dual alkali (LCDA) scrubbing process removes SO_2 and fine particulate matter in the Hydro-Sonic scrubbers. The scrubbing solution from the Hydro-Sonic scrubbers, made up of sodium sulfite/bisulfite/sulfate, is continuously pumped to a dual-reactor system where it is reacted with hydrated lime to precipitate calcium sulfite/sulfate solids. The solids are removed from the system through thickening and filtration, and the reclaimed solution is returned to the scrubber. The LCDA installation includes raw material storage tanks, three reactor tanks, thickener/clarifier, filtration (feed tank with vacuum filtering process), and a double-lined landfill with leachate collection. The flue gas passes through the GMCS collectors prior to exiting the stack, with mercury being collected from the flue gas by GMCS proprietary sorbent polymer catalyst (SPC) material in each of the GMCS modules. GMCS water blowdown is sent along with the Hydrosonic scrubber solution for treatment in the LCDA scrubbing process. Each collector is constructed with a minimum of a 6x6 array of GMCS modules, stacked four modules high, for a total of at least 144 modules per kiln emission train with a total of at least 576 modules all across all four kiln emission trains.

Permitting History

The following information was derived from a review of the permit files available to DEQ. Permit status is noted as active and in effect (A) or superseded (S).

February 11, 2016	T1-2014.0001, Renewed Tier I operating permit (A)
April 20, 2015	P-2012.0055, Increase the stated amount of CO in the thermal oxidizer and clarify temperature measurement, Permit status (A)
June 23, 2014	P-2012.0055, Modification of P-030316 to install and operate a new screening system, Permit status (S)
March 4, 2014	T2-2012.0016, Established a Mercury Best Available Control Technology (MBACT) emission standard, Permit status (A, will be S as a result of this project)
October 1, 2010	P-030316, Facility-wide permit to resolve past PSD issues, Permit status (S)
November 17, 2009	T2-2009.0109, Established permit requirements in 40 CFR 51.308(e) and IDAPA 58.01.01.668 for Best Available Retrofit Technology (BART), Permit status (A)
July 14, 2009	T1-2009.0121, Renewed Tier I operating permit (S)
December 30, 2002	No. 029-00001, Initial Tier I operating permit (S)
October 23, 2000	Permit No. 029-00001, The emission reductions scale-room scrubber shutdown operating permit was amended to replace pound per hour fugitive emission limits with reasonable control requirements. The permit number also changed to 029-00001 on November 1, 2000, which superseded the permit issued on October 23, 2000, but the permit pages still contain the October 23, 2000 date on each page. This permit expired on October 23, 2005. Although it is expired, it is still active. (A)
October 19, 2000	The new coke quartzite dryer and coke fines and electric furnace addition system permits were amended to replace pound per hour fugitive emission limits with reasonable control requirements. The permit number also changed to 029-00001 on November 1, 2000, which superseded the permit issued on October 19, 2000, but the permit pages still contain the October 19, 2000 date on each page. (A)
November 25, 1997	On October 8, 1997, DEQ received a letter from P4 Production stating that Monsanto Company had entered into a joint venture with Solutia, Inc., to form a new company called P4 Production, LLC. The letter requested that the PTCs held by Monsanto for the Enoch Valley Mine and the Soda Springs facility be reissued to P4 Production. The permits were issued on the basis that no modifications or emissions increases resulted from the transition and were issued solely to reflect a change of ownership of the permitted emissions units. (S) The coke fines and electric furnace addition system permit was reissued to P4 Production. The new coke quartzite dryer permit was reissued to P4 Production
September 12, 1991	DEQ canceled the dust slurry system PTC after receiving notification from Monsanto that the dust slurry system was permanently shut down. (Permit canceled)
April 3, 1990	Permit No. 0420-0001, An operating permit was issued to Monsanto for emission reductions scale-room scrubber shutdown and a new coke and quartzite dryer. (S)

May 15, 1987	Permit No. 0420-0001, Monsanto was issued a PTC for the dust slurry system. (Permit canceled)
April 15, 1986	Permit No. 0420-0001, A PTC was issued to Monsanto for the new coke and quartzite dryer. This permit, and other permits, were appealed on May 13, 1986. Additional information was submitted, and a draft permit was issued on August 26, 1986. The draft was revised and reissued on November 18, 1986 as another draft permit. This permit action was combined with others and issued as Permit No. 0420-0001 on April 3, 1990. (S)
November 19, 1985	Permit No. 0420-0001, The facility was issued a permit with modified pages of operating permit No. 0420-0001 for a pot tapping emission reduction credit. This permit was voided on May 15, 1987 (S)
November 7, 1985	Permit No. 0420-0001, Permit modification to for the installation of the coke fines electric furnace addition system. This permit and other permits were appealed on May 13, 1986. Additional information was submitted, and a draft permit was issued on August 26, 1986. The draft was revised and reissued on November 18, 1986 as another draft permit. This permit action was combined with others and was issued as Permit No. 0420-0001 on April 3, 1990. (S)
August 13, 1981	Part IV of the operating permit issued July 18, 1979, was amended to give Monsanto a compliance extension for installation of dust control equipment on its stocking system. (A)
July 18, 1979	No. 13-0420-0001-00, Initial permit for the facility for the following equipment and processes: A natural gas-fired boiler, phosphate ore-nodulizing kiln and cooler, crushing and screening with emissions controlled by a venturi scrubber, coke and quartzite handling and storage with emissions controlled by four baghouses, coke dryer and quartz dryer with emissions controlled by a scrubber, proportioning of phosphate ore, coke and quartzite and stocking area over furnaces, scale room transfer points controlled by a scrubber, the No. 7 electric arc furnace with emissions from the furnace tapping operations controlled by a scrubber, the No. 8 electric arc furnace with emissions from the furnace tapping operations controlled by a scrubber, and the No. 9 electric arc furnace with emissions from the furnace tapping operations controlled by a scrubber (S)

Application Scope

P4 Production has applied for a Tier II operating permit to satisfy the MBACT requirements of IDAPA 58.01.01.401.02.a.ii. This Rule requires existing facilities that have annual actual mercury emissions over 62 pounds per year to submit a Tier II operating permit application and an MBACT analysis. This Tier II permit application will also serve as the permit renewal as the current permit expired March 4, 2019.

The applicant has proposed to:

- Install the GORE™ Mercury Control System (GMCS) on the nodulizing kiln.

The applicant has proposed to install this system per the following schedule:

- Within two years of permit issuance the permittee has proposed complete the installation and start-up on one of the four exhaust streams;
- Within 12 months of installation and startup, a full-scale demonstration will be conducted to determine consistency with the pilot study performance;
- Within five years of permit issuance the permittee has proposed to complete the installation and operation on the three remaining exhaust streams.

This proposed construction schedule is assured by Permit Condition 1.2.

This permit application is consistent with DEQ's November 20, 2018 Agreement in Principle Regarding Approach to Establishing MBACT Emission Standard response to P4 Production, LLC.

Application Chronology

June 24, 2015	DEQ and P4 Production, LLC entered into a Compliance Agreement Schedule (CAS) as a result of Enforcement Case No. E-2015.0010
May 5, 2016	DEQ and P4 Production, LLC entered into a Corrective Action Plan (CAP) as result of the June 24, 2015 CAS
May 2016 to December 2018	P4 Production, LLC installed, operated, and tested a GORE™ Mercury Control System (GMCS) to determine if this system was technologically feasible as MBACT for the nodulizing kiln
March 18, 2019	DEQ received an application and an application fee.
April 15, 2019	DEQ determined that the application was complete.
June 4, 2019	DEQ made available the draft permit and statement of basis for peer and regional office review.
June 14, 2019	DEQ made available the draft permit and statement of basis for applicant review.
August 15 – Sept. 16, 2019	DEQ provided a public comment period on the proposed action.
September 26, 2019	DEQ issued the final permit and statement of basis.

TECHNICAL ANALYSIS

Emissions Units and Control Equipment

Table 1 EMISSIONS UNIT AND CONTROL EQUIPMENT INFORMATION

Source ID No.	Sources	Control Equipment	Emission Point ID No.
N/A	Nodulizing Kiln	Dust knockout chamber, North spray tower (nodulizing kiln spray tower)[a], eight parallel cyclonic separators (four pairs), four parallel Hydro-Sonic scrubbers, demisters, lime concentrated dual alkali (LCDA) SO_2 scrubbing system, and four parallel GMCS collectors	Four exhaust stacks

Emissions Inventories

In accordance with IDAPA 58.01.01.401.02.a.ii, a Tier II operating permit is required because the facility has actual mercury emissions greater than 62 pounds per year. Mercury emissions originate from raw materials used in the process (e.g. coke, quartzite, and phosphate ore). Over ninety-nine percent of the mercury emitted is from the Kiln Hydrosonic Stacks.

Ambient Air Quality Impact Analyses

An ambient air quality impact analysis was not performed for this project as the purpose of this Tier II permitting action is to allow the installation of mercury emissions control equipment.

REGULATORY ANALYSIS

Mercury Best Available Control Technology (MBACT) (IDAPA 58.01.01.006)

IDAPA 58.01.01.006 .... General Definitions

MBACT is defined, in part, as "An emission standard for mercury based on the maximum degree of reduction practically achievable as specified by the Department on an individual case-by-case basis taking into account energy, economic and environmental impacts, and other relevant impacts specific to the source."

The sources of mercury emissions at the facility were previously presented in Table 3. Because the mercury emissions estimate for the nodulizing kiln (emitted through the kiln hydrosonic stacks) are greater than two orders of magnitude greater than emissions from the nodule crushing and screening process or any other source of mercury emissions at the Facility, P4's MBACT analysis focused only on control of mercury emissions from the nodulizing kiln. The MBACT analysis is presented in Appendix B.

Attainment Designation (40 CFR 81.313)

The facility is located in Caribou County, which is designated as attainment or unclassifiable for $PM_{2.5}$, PM_{10}, SO_2, NO_2, CO, and Ozone. Refer to 40 CFR 81.313 for additional information.

Permit to Construct (IDAPA 58.01.01.201)

IDAPA 58.01.01.201 .... Permit to Construct Required

The application was submitted for a Tier II operating permit (refer to the Tier II Operating Permit section) and the installation of mercury emissions controls does not meet the definition of a "modification" per 58.01.01.006. Therefore, the procedures of IDAPA 58.01.01.200–228 are not applicable to this permitting action.

Tier II Operating Permit (IDAPA 58.01.01.401)

IDAPA 58.01.01.401 .... Tier II Operating Permit

In accordance with IDAPA 58.01.01.401.02.a.ii, a Tier II operating permit is required because the facility has annual actual mercury emissions greater than 62 pounds. The applicant submitted a MBACT analysis for review and approval as required by this section of the Rules.

Standards for New Sources (IDAPA 58.01.01.676)

IDAPA 58.01.01.676 .... Standards for New Sources

This permit action does not affect any emission unit subject to an NSPS.

Title V Classification (IDAPA 58.01.01.300, 40 CFR Part 70)

IDAPA 58.01.01.301 .... Requirement to Obtain Tier I Operating Permit

P4 is an existing Tier I major facility and is currently operating under Tier I Operating Permit T1-2014.0001 issued February 11, 2016. Tier I permits include all existing applicable requirements as defined by IDAPA 58.01.01.008.03. The MBACT Tier II permit requirements of IDAPA 58.01.01.401.02.a.ii are not applicable requirements definition because the rule is not part of Idaho's Clean Air Act State Implementation Plan. Therefore the Tier I operating permit does not need to be reopened to include the permit conditions.

PSD Classification (40 CFR 52.21)

40 CFR 52.21 .... Prevention of Significant Deterioration of Air Quality

The facility is only proposing the installation of mercury emissions control equipment which does meet the definition of modification per the PSD Rules. Therefore, PSD requirements are not applicable to this permitting action.

NSPS Applicability (40 CFR 60)

This permitting action does not affect any emission unit subject to an NSPS.

NESHAP Applicability (40 CFR 61)

This permitting action does not affect any emission unit subject to an NESHAP.

MACT/GACT Applicability (40 CFR 63)

This permitting action does not affect any emission unit subject to a MACT/GACT.

Permit Conditions Review

This section describes the permit conditions for this initial permit or only those permit conditions that have been added, revised, modified or deleted as a result of this permitting action.

Existing Permit Condition 1.1 was revised to require the installation of the GMCS on the nodulizing kiln.

New Permit Condition 1.2 was included to require the phased installation of the GMCS on the four exhaust streams per the schedule as proposed by the applicant and approved by DEQ, using a phased construction approach.

Existing Table 1.1 was revised to specify the GMCS as control equipment for the nodulizing kiln.

Existing Table 2.1 was revised to specify the GMCS as control equipment for the nodulizing kiln.

Existing Permit Condition 2.3 was revised to remove the annual pounds per year mercury emissions limit and replace it with the installation of GMCS and a mercury emissions target control efficiency. This was done due to the current absence of any commercially available control technology capable of reliably controlling mercury emissions from P4's facility, given the operating conditions specific to the kiln (i.e. moisture and temperature, etc.) and the substantial variability in the mercury concentration contained in P4's phosphate ore, and because add-on mercury emissions controls are now being proposed to be installed when previously there were none. This was also done because the GMCS has only been operating, as of this permitting action, on a pilot basis. As such, the mercury emissions target control efficiency has not yet been determined for the full-scale installation proposed for this project.

Existing Permit Condition 2.4 was removed as the hydrosonic scrubbers will only be considered a particulate matter emissions control going forward and will no longer be considered the primary mercury control now that the GMCS is being installed on the nodulizing kiln.

Existing Permit Condition 2.5 is now Permit Condition 2.4.

Permit Condition 2.5 is a new requirement specifying the installation and operational requirements of the GMCS that are to be established once the full-scale GMCS is installed on the first nodulizing kiln exhaust stream.

Existing Permit Condition 2.6 was previous Permit Condition 2.9.

Existing Permit Condition 2.7 was replaced with the new proposed source testing requirements of Permit Conditions 2.9 and 2.10. This was done to replace the existing initial, third year, and fifth year of the permit source testing with more frequent testing (see Permit Conditions 2.9 and 2.10 discussions).

Existing Permit Condition 2.8 was removed since it required monitoring of the Hydro-Sonic scrubbers which, as previously discussed, has been removed (see previous Permit Condition 2.4 discussion).

Existing Permit Condition 2.9 is now Permit Condition 2.6.

New Permit Condition 2.8 was included to require the submission of an O & M plan for the GMCS.

New Permit Condition 2.9 was included to require short-term mercury emissions testing on each of the exhaust streams once the GMCS is installed. For example, short term testing will begin within 30 days of installation of the GMCS on the first exhaust steam and will be triggered on the each of the three remaining exhaust streams as the installations proceed. This was done to ensure that the GMCS was properly maintained and operated continuously during the operation of the nodulizing kiln.

New Permit Condition 2.10 was included to require long-term mercury emissions source testing on each of the exhaust streams once the GMCS is installed. For example, long term testing will begin within one year of installation of the GMCS on the first exhaust steam and will be triggered on the each of the three remaining exhaust streams as the installations proceed. This was also done to ensure that the GMCS was properly maintained and operated continuously during the operation of the nodulizing kiln. This permit condition was also included to ensure that the short term mercury emission testing was effective in determining the GMCS performance.

New Permit Condition 2.11 was included to require that the short-term mercury testing results will be submitted to DEQ on a timely basis. This was done to ensure that mercury emissions are being controlled by the GMCS.

New Permit Condition 2.12 was included to require that the long term mercury source testing results will be submitted to DEQ per the Performance Testing General Provisions. This was done to ensure mercury emissions are being controlled by the GMCS.

New Permit Condition 2.13 was included to require that an interim report be submitted to DEQ to determine an agreed upon mercury emissions target control efficiency for the full-scale GMCS installation going forward.

New Permit Condition 2.14 was included to require a final report be submitted to DEQ along with a permit revision and/or renewal application. This was done to ensure that a permit is applied for and issued by DEQ that contains the full permitting and compliance requirements for the GMCS. This will be a result of the testing, operating requirements determinations, and mercury emissions target control efficiency determination requirements for the GMCS on the full scale application required by this current permitting action.

PUBLIC REVIEW

Public Comment Period

A response to public comments document has been crafted by DEQ based on comments submitted during the public comment period. That document is part of the final permit package for this permitting action.

APPENDIX A – EMISSIONS INVENTORIES

Point Source Emission Calculations

Determination of Potential Mercury Emissions for P4 Productions, Soda Springs, Idaho

Reference ID	Process Area	Emission Source	2008 Mercury Emissions (lb/yr)	2009 Mercury Emissions (lb/yr)	2010 Mercury Emissions (lb/yr)	2011 Mercury Emissions (lb/yr)	2012 Mercury Emissions (lb/yr)	2013 Mercury Emissions (lb/yr)	2014 Mercury Emissions (lb/yr)	2015 Mercury Emissions (lb/yr)	2016 Mercury Emissions (lb/yr)	2017 Mercury Emissions (lb/yr)	Average 2008 - 2017 Hg Emissions (lb/yr)	Potential Emissions[1, 2] (lb/yr)
101.1	Coke Bunker Baghouse	Coke Bunker Baghouse Stack	2.60E-09	4.44E-08	5.06E-08	3.14E-08	8.80E-08	2.03E-09	5.42E-09	3.35E-09	1.18E-10	0.00E+00	2.28E-08	4.95E-08
102	Vactor Truck Vent - Coke Bunker BH Unloading	Vactor Truck Vent Stack	4.82E-10	4.82E-10	4.82E-10	4.82E-10	4.82E-10	4.82E-10	4.82E-10	4.82E-10	4.82E-10	9.18E-10	5.26E-10	1.14E-09
108.4	Dryer BH	Dryer Baghouse Stack	1.39E-05	1.05E-05	1.40E-05	1.45E-05	1.30E-05	4.40E-05	1.35E-05	1.87E-05	1.11E-05	1.88E-05	1.72E-05	3.74E-05
109	Vactor Truck Vent - Dryer BH Unloading	Vactor Truck Vent Stack	2.22E-09	2.22E-09	2.22E-09	2.22E-09	2.22E-09	2.22E-09	2.22E-09	2.22E-09	2.22E-09	4.23E-09	2.42E-09	5.27E-09
112.1	105 Baghouse	105 Baghouse Stack	6.96E-06	5.03E-06	7.05E-06	7.48E-06	7.40E-06	7.56E-06	7.69E-06	7.27E-06	6.76E-06	7.47E-06	7.07E-06	1.54E-05
116	Vactor Truck Vent - 105 BH Unloading	Vactor Truck Vent Stack	2.31E-09	2.31E-09	2.31E-09	2.31E-09	2.31E-09	2.31E-09	2.31E-09	2.31E-09	2.31E-09	4.40E-09	2.52E-09	5.47E-09
119.1	Coke Handling Baghouse (C&Q)	Coke Handling Baghouse Stack	1.63E-05	1.24E-05	1.75E-05	1.82E-05	1.83E-05	1.89E-05	1.77E-05	1.68E-05	1.55E-05	1.72E-05	1.69E-05	3.67E-05
121	Vactor Truck Vent - C&Q BH Unloading	Vactor Truck Vent Stack	7.12E-09	7.12E-09	7.12E-09	7.12E-09	7.12E-09	7.12E-09	7.12E-09	7.12E-09	7.12E-09	1.36E-08	7.77E-09	1.69E-08
134.2	Bulk Storage Bin Baghouse (Coke Fines BH)	Bulk Storage Bin Baghouse Stack	1.98E-09	2.14E-09	9.70E-09	1.56E-08	2.50E-09	9.04E-10	1.03E-10	4.07E-08	0.00E+00	0.00E+00	7.36E-09	1.60E-08
202.1	104 Baghouse	104 Baghouse Stack	7.29E-04	8.04E-04	8.05E-04	6.75E-04	8.04E-04	7.89E-04	8.05E-04	8.05E-04	8.02E-04	8.04E-04	7.82E-04	1.70E-03
310	Kiln Hydrosonics	Kiln Hydrosonics Stacks (4)	609.20	510.70	583.85	616.07	601.57	589.30	857.62	874.92	865.86	1276.22	738.53	1605.00
314	Cooler Spray Tower	Cooler Spray Tower Stack	7.53E-01	5.19E-01	6.09E-01	6.49E-01	6.31E-01	6.16E-01	6.39E-01	6.54E-01	6.46E-01	1.40E-01	5.85E-01	1.27E+00
403	Nodule Reclaim Baghouse	Nodule Reclaim Baghouse Stack	7.37E-05	7.33E-05	7.40E-05	7.45E-05	2.54E-03	7.27E-05	6.89E-05	7.41E-05	7.05E-05	7.17E-05	3.20E-04	6.95E-04
409	Nodule Crushing and Screening Scrubber	Nodule Crushing and Screening Scrubber Stack	2.15E+00	1.59E+00	2.11E+00	2.28E+00	1.52E+00	1.40E-01	1.29E-01	1.06E-01	3.79E-04	8.28E-01	1.09E+00	2.36E+00
429	SDM Bin Vent	SDM Bin Vent Stack	1.51E-04	1.50E-04	1.50E-04	1.50E-04	1.50E-04	1.47E-04	1.49E-04	1.50E-04	1.50E-04	1.50E-04	1.50E-04	3.25E-04
501	Scaleroom Baghouse	Scaleroom Baghouse Stack	6.41E-05	4.82E-05	6.59E-05	6.88E-05	6.70E-05	6.93E-05	6.90E-05	6.67E-05	6.37E-05	7.08E-05	6.53E-05	1.42E-04
523	Vactor Truck Vent - Scaleroom BH Unloading	Vactor Truck Vent Stack	2.37E-09	2.37E-09	2.37E-09	2.37E-09	2.37E-09	2.37E-09	2.37E-09	2.37E-09	2.37E-09	4.52E-09	2.59E-09	5.62E-09
523.2	Vactor Truck Vent - Scaleroom Vacuum System	Vactor Truck Vent Stack	2.37E-09	2.37E-09	2.37E-09	2.37E-09	2.37E-09	2.37E-09	2.37E-09	2.37E-09	2.37E-09	4.52E-09	2.59E-09	5.62E-09
524	Main Furnace Baghouse	Main Furnace Baghouse Stack	2.32E-05	1.74E-05	2.38E-05	2.49E-05	2.42E-05	2.50E-05	2.49E-05	2.42E-05	2.30E-05	2.56E-05	2.36E-05	5.13E-05
530.2	Vactor Truck Vent - Main Stocking BH Unloading	Vactor Truck Vent Stack	2.15E-09	2.15E-09	2.15E-09	2.15E-09	2.15E-09	2.15E-09	2.15E-09	2.15E-09	2.15E-09	4.09E-09	2.34E-09	5.09E-09
544	No. 7 CO Dust Baghouse	No. 7 CO Dust Baghouse Stack	1.09E-06	7.62E-07	1.18E-06	1.18E-06	1.04E-06	1.16E-06	1.28E-06	1.20E-06	1.12E-06	1.24E-06	1.13E-06	2.45E-06
544.1	#7 CO Dust Collection Bypass	#7 CO Dust Collection Bypass Stack	1.26E-07	6.55E-07	5.24E-08	5.68E-08	8.74E-08	1.19E-06	5.96E-07	2.38E-06	8.41E-07	3.63E-06	9.61E-07	2.09E-06
546	#7 THFC	#7 THFC Stack	6.14E-02	4.29E-02	6.64E-02	6.67E-02	1.72E-02	1.92E-02	2.11E-02	1.97E-02	1.85E-02	2.05E-02	3.54E-02	7.68E-02
554	#304 Coke Fines Bin Vent	#304 Coke Fines Bin Vent Stack	3.06E-07	1.58E-07	5.90E-07	9.88E-07	1.87E-07	3.80E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.23E-07	4.85E-07
555	#305 Coke Fines Bin Vent	#305 Coke Fines Bin Vent Stack	5.23E-08	2.02E-07	1.20E-06	2.13E-06	5.46E-07	2.90E-07	1.60E-08	0.00E+00	0.00E+00	0.00E+00	4.44E-07	9.65E-07
568	No. 8 CO Dust Baghouse	No. 8 CO Dust Baghouse Stack	2.57E-06	2.12E-06	2.27E-06	2.65E-06	2.59E-06	2.68E-06	2.57E-06	2.40E-06	2.51E-06	2.78E-06	2.51E-06	5.46E-06
568.1	#8 CO Dust Collection Bypass	#8 CO Dust Collection Bypass Stack	3.95E-07	5.02E-06	8.41E-08	1.10E-07	2.96E-06	2.69E-06	2.48E-06	5.30E-06	2.01E-06	6.97E-06	2.60E-06	6.09E-06
570	#8 THFC	#8 THFC Stack	5.53E-02	4.58E-02	4.89E-02	5.71E-02	3.23E-02	3.34E-02	3.20E-02	2.98E-02	3.13E-02	3.46E-02	4.00E-02	8.70E-02
578	#306 Coke Fines Bin Vent	#306 Coke Fines Bin Vent Stack	3.40E-07	4.82E-07	6.05E-07	1.27E-06	2.45E-07	7.92E-08	4.46E-09	0.00E+00	0.00E+00	0.00E+00	3.03E-07	6.58E-07
579	#307 Coke Fines Bin Vent	#307 Coke Fines Bin Vent Stack	4.22E-07	8.29E-07	1.26E-06	2.67E-06	2.09E-07	1.50E-07	4.62E-09	0.00E+00	0.00E+00	0.00E+00	5.55E-07	1.21E-06
592	No. 9 CO Dust Baghouse	No. 9 CO Dust Baghouse Stack	1.64E-06	1.20E-06	1.80E-06	1.81E-06	1.75E-06	1.84E-06	1.84E-06	1.88E-06	1.81E-06	1.80E-06	1.74E-06	3.78E-06
592.1	#9 CO Dust Collection Bypass	#9 CO Dust Collection Bypass Stack	3.77E-07	1.55E-06	7.90E-07	2.93E-07	3.44E-07	2.10E-06	2.65E-06	3.01E-06	4.28E-06	9.04E-07	1.63E-06	3.54E-06
594	#9 THFC	#9 THFC Stack	7.63E-03	5.55E-03	8.35E-03	8.38E-03	8.12E-03	8.55E-03	6.52E-03	8.75E-03	8.42E-03	8.37E-03	8.06E-03	1.75E-02
602	#308 Coke Fines Bin Vent	#308 Coke Fines Bin Vent Stack	4.99E-07	5.59E-07	7.59E-07	2.20E-06	5.33E-07	1.44E-07	3.14E-09	0.00E+00	0.00E+00	0.00E+00	4.70E-07	1.02E-06
603	#309 Coke Fines Bin Vent	#309 Coke Fines Bin Vent Stack	1.77E-06	1.81E-06	4.10E-06	4.36E-06	1.15E-06	3.78E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.36E-06	2.95E-06
610	Vactor Truck Vent - Dust Container Unloading	Vactor Truck Vent Stack	2.07E-09	2.07E-09	2.07E-09	2.07E-09	2.07E-09	2.07E-09	2.07E-09	2.07E-09	2.07E-09	3.95E-09	2.26E-09	4.91E-09
855.2	Vactor Truck Vent - Lab BH Unloading	Vactor Truck Vent Stack	3.42E-10	3.42E-10	3.42E-10	3.42E-10	3.42E-10	3.42E-10	3.42E-10	3.42E-10	3.42E-10	6.51E-10	3.73E-10	8.10E-10
		Total Point Source:	612.23	512.91	586.69	619.14	603.79	590.12	858.45	875.73	866.57	1277.25	740.29	1608.82
		Total Fugitive Source:	**0.04**	**0.03**	**0.04**	**2.39**	**1.07**	**0.91**	**0.77**	**0.74**	**0.74**	0.65	0.74	1.60
		Grand Total:	**612.27**	**512.94**	**586.73**	**621.53**	**604.86**	**591.03**	**859.22**	**876.47**	**867.31**	1277.90	741.03	1610.42

Note 1 - Potential Emissions have been determined by increasing the average actual emission rate for each point source by the ratio of Kiln PTE/Kiln Average Actual Hg Emissions

Note 2 - Hg Emissions of 1605 lbs per year from the Nodulizing Kiln determined as follows:

Kiln Mercury emission test results:

Gaseous mercury: 0.1720 lb/hr (June 2017 stack test)
Particulate mercury: 0.0019 lb/hr (June 2017 stack test)
Ore throughput during June 2017 test: 239.3 ton/hr

Kiln Gaseous Hg emission factor:
(0.1720 lb/hr)/(239.3 ton/hr) = 7.19×10^{-4} lb/ton

Kiln Particulate Hg emission factor:
(0.0019 lb/hr)/(239.3 ton/hr) = 7.94×10^{-6} lb/ton

Kiln Overall Hg emission factor:
7.19×10^{-4} lb/ton + 7.94×10^{-6} lb/ton = 7.27×10^{-4} lb/ton
Maximum ore throughput:
(252 ton/hr) x (8,760 hr/yr) = 2,207,520 ton/yr

Maximum kiln emissions (Potential to Emit):

(7.27×10^{-4} lb/ton) x (2,207,520 ton/yr) = 1605 lb/yr

APPENDIX B – MBACT ANALYSIS

Top Down MBACT Analysis
Nodulizing Kiln at the P4 Production, LLC Plant

TOP DOWN MBACT ANALYSIS

Proposal

Modification to the Nodulizing Kiln at the P4 Production, LLC Facility

P4 Production, LLC (P4) operates an existing elemental phosphorous production facility which is located near Soda Springs, ID. The plant processes phosphate ore to produce elemental phosphorus for sale. There are two primary departments at the Facility – the Burden Preparation Department and the Furnace Department.

The Burden Preparation Department includes activities associated with handling and beneficiation of raw materials (coke, quartzite, and phosphate ore) to produce a suitable feedstock for processing by the Furnace Department to produce elemental phosphorus. Ore is received and stockpiled onsite. Ore is then conveyed to a nodulizing kiln for processing. The resulting nodules are cooled and stockpiled or sent directly to the nodule sizing and scale room from the cooler. In the scale room the nodules are blended with coke and quartzite. The coke and quartzite are received and stockpiled separately at the facility and are dried to a desired moisture content, if necessary, prior to blending with the nodules. The nodule-coke-quartzite blend (burden) is then sent to the Furnace Department for processing. Fuel used in the nodulizing kiln is primarily carbon monoxide (CO) off-gas from the furnace process which is supplemented with small quantities of natural gas and coal. The nodulizing kiln off-gas is treated with existing air pollution control equipment including a series of dust bins, a spray tower, and four parallel hydrosonic venturi scrubbers. The hydrosonic venturi scrubbers are fed with lime concentrated dual alkali (LCDA) solution to scrub acid gases, primarily SO_2, from the gas flow.

The Furnace Department operations utilize electric arc furnaces to melt the burden, chemically react the components, and create off-gases containing elemental phosphorus. The burden enters one of three electric furnaces (identified by the facility as Furnaces No. 7, No. 8, and No. 9) that operate on a continuous basis at temperatures of 1,400 to 1,500 °C (2,550 to 2,732 °F). The reducing environment in the furnaces reacts phosphate from the nodules to form phosphorus gas, carbon monoxide gas, and molten slag and ferrophosphorus. The furnace gases, composed of mainly carbon monoxide and phosphorus, are drawn through electrostatic precipitator (ESP) dust collectors where particulate matter is removed. The cleaned gases are then sent through water spray condensers where the gases are cooled, condensing the phosphorus. The condensed phosphorus is pumped to settling/storage tanks for further solids removal and product storage. The stored phosphorus is loaded into water-blanketed railroad cars for shipment to market.

After the removal of phosphorus, the furnace off-gas is composed primarily of CO and water vapor. The CO is then sent to the nodulizing kiln as fuel. Excess CO is combusted in a thermal oxidizer (TO) unit the resulting off-gases are treated with three parallel high energy venturi scrubbers.

The furnaces are periodically tapped to remove accumulated molten slag and ferrophosphorus. Slag taps occur about 45 – 48 times per day per furnace and last about 15 minutes per tap. The ferrophosphorus is tapped once or twice per day per furnace. The tapping gases pass through a high energy venturi scrubber equipped with an entrainment separator before discharge to the atmosphere.

The molten slag is tapped into cast steel ladles that are transported and poured onto the slag storage pile at the site. The ferrophosphorus is also collected in ladles, cooled, and stockpiled on-site.

The phosphate ore and various other raw materials used in the process contain trace amounts of mercury (Hg). Mercury leaves the process either in solid process intermediates or in air emissions. Mercury is a naturally-occurring metal normally found in trace amounts in rock and mineral formations. In the P4 production process, mercury exists in trace amounts in the ore and to a lesser extent other raw materials used in the process. Mercury has three possible valence states; elemental mercury (Hg^0), mercuric state (Hg^{2+}), and mercurous (Hg^+). Particle-bound mercury (Hg_{PB}) refers to mercury contained in particles in the gas stream. The exact speciation of Hg in raw phosphate ore is uncertain; however, at the high temperatures within the nodulizing kiln (~1,500 °C or ~2,732 °F) it is theorized that most of the Hg in the ore is volatilized and enters the process air stream as elemental mercury, Hg^0. This is supported by low relative quantities of Hg observed in discrete samples of ore and nodules.

As the process gases are cooled, the interactions of the gaseous elemental Hg^0 with other constituents in the gas results in a portion of the Hg^0 being converted to other forms. Generally, some amount of the Hg^0 is oxidized to Hg^{2+} or Hg+. In theory, the oxidized Hg^{2+} compounds in the process gas include mercury chloride (HgCl), mercury oxide (Hg0), and mercury sulfate ($HgSO_4$). There is no evidence that Hg^+ exists in the P4 processes. Some amount of mercury in the process exhaust gas exists as Hg_{PB}.

The oxidized and particle-bound forms of mercury are the readily controlled forms, while control of elemental Hg^0 is more challenging. In general, the mercury control strategies include maximizing the control of the Hg^{2+} and Hg_{PB} forms of mercury, and forcing the Hg^0 in the flue gas to the controllable forms.

As a result of elemental mercury in the phosphate ore processed by the facility gaseous mercury is emitted by the facility in excess of 62 pounds per year. Therefore, as required by IDAPA 58.01.01.401.02.ii, a MBACT analysis was required to be performed. This analysis was previously performed in March 2014, under project 61025, and resulted in an annual mercury emissions permit limit of 746.4 pounds per year. This permit also required performance testing (stack tests) to demonstrate compliance with the mercury emission limit of 746.4 pounds per any consecutive 12 calendar month period. This permit also established a kiln throughput limit to be calculated using the mercury emission factor established through source testing or 2,188,856 tons per year, whichever is more stringent.

However, the kiln throughput limit was based on a single stack test from 2002 which was intended to reflect the facility's potential to emit for mercury. Using a single stack test to develop the mercury mass emission limit did not account for potential variability of the mercury content of the ore and thus the variability of mercury liberated from the ore in the kiln. Subsequent stack testing results from August 2014 and December 2014 indicated that mercury emissions from the kiln would exceed the permitted mercury emission limit sometime in 2015 if P4 were to continue operating at the current production rate. To avoid curtailing operations below the current production rate P4 submitted an application and an updated MBACT analysis in March 2015 to amend its existing Tier II Operating Permit and to increase the annual mercury emissions limit.

In early April 2015, IDEQ deemed the March 2015 application incomplete, requiring additional clarification to technical information in the MBACT analysis. P4 responded in April 2015 with supplemental information. After additional review, both P4 and IDEQ agreed that due to the unique characteristics of the kiln, additional time was needed to research, analyze, install, and test potentially available mercury control technologies. As a result, IDEQ determined that issuing a revised Tier II Operating Permit would be infeasible at that time. To address this, P4 and IDEQ entered into a Compliance Agreement Schedule (CAS) on July 23, 2015, that contained requirements for P4 to install additional mercury controls (i.e., devices, technologies, and/or management practices) to reduce mercury emissions from the kiln stacks, with a schedule for P4 to develop a Corrective Action Plan (CAP) for IDEQ review and approval. The CAP would outline the specific schedule and activities that P4 was to

implement as part of the mercury control technology evaluation. In addition, IDEQ agreed to exercise enforcement discretion and not take action against P4 should P4 exceed the rolling annual mercury limit then in place as long as P4 complied with the CAS.

P4 submitted its CAP to IDEQ in October 2015 and revised it in June 2016. In anticipation of the CAP approval from IDEQ, P4 submitted two separate MBACT analyses: (1) from MJB Services, LLC in April 2016, and (2) from AECOM3 in June 2016. While the analysis by MJB Services did not identify any additional available mercury control technology, AECOM's MBACT analysis concluded GORE™ Mercury Control System (GMCS) might be a potentially feasible control technology. IDEQ subsequently approved the CAP in July 2016.

Shortly after submission of the AECOM report, P4 submitted a test plan regarding a slipstream pilot demonstration of GMCS. P4 worked in conjunction with GORE™ associates to design and construct a pilot unit for testing. GORE™ suggested its GMCS technology could potentially remove between 50-70% of mercury in the gas stream. Testing of the technology began in September 2016. Pilot data indicated that the GMCS was able to reduce mercury emissions from the kiln flue gas to meet the range GORE™ recommended for a successful demonstration. However, upon sampling of the GMCS sorbent material and later the wash water, P4 discovered that a significant portion of the captured mercury was not accumulating in the GMCS system (as designed), but rather was exiting with the wash water. After review and approval of a schedule extension by IDEQ, P4 installed a water treatment pilot system. Testing of the water treatment pilot system showed that mercury captured in the GMCS wastewater could be removed using technology like the facility's existing LCDA water treatment process.

The pilot testing suggested that the GMCS could be MBACT for the kiln. Therefore, in October 2018, P4 submitted a letter to IDEQ outlining a proposed approach to update the Facility's previous MBACT analysis and submit an application to modify the existing Tier II Operating Permit proposing full-scale implementation of GMCS as MBACT. IDEQ agreed in principle to this strategy in November 2018.

Therefore, a Top Down MBACT analysis for mercury emissions from the nodulizing kiln at the P4 plant was performed as follows.

BACT Analysis for Mercury Emissions from the Nodulizing Kiln at the P4 Plant

Mercury is emitted from the nodulizing kiln during the production of elemental phosphorus at the P4 Plant.

Step 1 – Identify all control technologies

The following sources of data on controls and emissions limits were reviewed to identify potential control techniques for mercury emissions from the nodulizing kiln at the P4 plant:

- U.S. EPA's RACT/BACT/LAER Clearinghouse (RBLC) database, and
- Vendor information provided by P4

This review indicates that there are ten possible control options available for reducing mercury emissions:

- Activated Carbon Injection (ACI) with the existing scrubbers,
- ACI with new polishing baghouses downstream of the existing scrubbers,
- Non-carbon sorbent injection,
- Halide injection,
- Halide injection with ACI and new polishing baghouses,
- Fixed-Bed oxidation catalysts,

- Fixed carbon beds,
- Calomel scrubbers,
- Scrubber additives, and
- GORE™ Mercury Control System (GMCS)

Each of these control technologies are discussed in depth as follows.

Activated Carbon Injection (ACI) with the existing scrubbers - ACI works by introducing powdered activated carbon (PAC) into the flue gas stream where it adsorbs gas phase mercury. The PAC is then captured, along with the mercury, downstream in the existing scrubbers. Both elemental and oxidized (most favorable) forms of mercury can be adsorbed onto the carbon particles. Since mercury is adsorbed onto the PAC in the ductwork, prior to the particulate control device, the distance from the PAC injection point to the particulate control device (i.e., the residence time) has a significant impact on the level of achievable control. In addition, the gas temperature and moisture content significantly alters the performance of PAC. ACI systems perform best with flue gas temperatures between 200 °F and 400 °F and minimal moisture content. Moisture in the flue gas can blind adsorption sites on the PAC. Adding halogens, such as bromine (i.e. brominated PAC), iodine, or chlorine, to the activated carbon can increase the mercury oxidation, which in turn increases capture in the particulate control device. ACI could be installed both upstream and downstream of the spray tower; however, significant process modifications would be required, and this has not been demonstrated commercially in a wet flue gas environment.

ACI with new polishing baghouses downstream of the existing scrubbers – As discussed previously, ACI can adsorb gas phase mercury from the flue gas to form particulate bound mercury. However, while the existing scrubbers can handle some additional particulate loading due to ACI, small and less dense PAC particulates may not be able to be controlled with the design of the existing scrubbers. To address this issue, enhanced particulate controls (i.e. a new polishing baghouse) can be installed downstream of the existing scrubbers. The net effect of installing new controls is to increase the capture efficiency of particulates and thereby increase the overall mercury reduction of ACI.

Non-carbon sorbent injection - Non-carbon sorbents adsorb mercury similar to the previously discussed ACI. Non-carbon sorbents have been researched as an alternative to ACI in the utility sector to avoid fly ash contamination from PAC. The sorbents have been designed to be more effective at higher temperatures compared to PAC. The MJB MBACT report evaluated silicate based sorbents, SBS Injection® Technology, and palladium based sorbents. Implementation of non-carbon sorbent injection may require additional particulate controls to accommodate the additional sorbent loading as previously.

Halide injection - Oxidizing agents, typically halogens, convert elemental mercury to oxidized mercury through an oxidation reaction. Oxidized mercury can be more readily captured by the existing scrubber by adsorbing to particulates or dissolving in scrubber water since oxidized mercury is water soluble. Oxidation of mercury is achieved by the reaction of elemental mercury with halogen gases (Cl_2, Br_2, HCl, HBr, etc.) that form from the dissociation of the injected halide. The current exhaust temperatures of the kiln are sufficient to dissociate halide compounds.

Oxidizing agents can be injected directly into the flue gas stream. Halides that have been previously evaluated in P4 MBACT analyses include HCl, $CaBr_2$, and HBr. The taconite processing industry researched this technology to determine its ability to reduce mercury emissions from indurating furnaces. This analysis focuses on $CaBr_2$ injection because it is readily available and has demonstrated to have the highest mercury reductions from short-term testing in other industries.

Halide injection with ACI and new polishing baghouses - This technology functions similar to ACI with new polishing baghouses downstream of the existing scrubbers, with the exception that halides are injected as well to promote additional oxidation of elemental mercury (as discussed previously) in the flue gas. Oxidized mercury is more likely to adsorb to PAC, thus the net effect is to boost the control efficiency of ACI with a polishing baghouse.

Fixed-Bed oxidation catalysts - Research in the utility sector on coal-fired power plants has shown that catalyst beds have the ability to oxidize elemental mercury by lowering the activation energy required to facilitate the reaction. As discussed previously under halide injection, oxidized mercury is more likely to be captured by the existing scrubbers.

Typically, these catalysts are used for NO_X control in selective catalytic reduction (SCR) reactors. However, SCR can facilitate the conversion of SO_2 to SO_3, which can inhibit the oxidation of elemental mercury.

Fixed carbon beds – Fixed bed carbon adsorption consists of routing flue gases through a vessel packed with activated carbon. The flue gas passes through a series of vessels where the fixed carbon beds remove the mercury from the flue gas. The carbon contains many pores with active adsorption sites, which capture mercury as the flue gas flows through.

Calomel scrubbers – Calomel scrubbers utilize the Boliden-Norzink process to react elemental mercury with mercuric chloride to form a calomel (mercurous chloride) precipitate. The calomel precipitate is then removed from the flue gas in downstream particulate control devices. The calomel can be regenerated with chlorine gas or sold to a mercury refiner. Typically, this technology is applied to gold ore roasters (e.g. Barrick Gold's Goldstrike Mine) where the exhaust flows are relatively small and the mercury in the exhaust is present in higher concentrations. For example, the exhaust flow treated at Barrick is approximately 14,000 acfm in comparison to 300,000 acfm for the nodulizing kiln at P4. In addition, the mercury concentration in the exhaust at Barrick is approximately 300 mg/dscfm as opposed to 300μg/dscfm at P4.

Scrubber additives – As discussed in the MJB MBACT report, scrubber additives were developed to prevent re-emissions of captured mercury from scrubber water back into the exhaust stream. Testing has been conducted at coal- fired power plants and the taconite industry to a limited extent and the results have varied greatly.

GMCS – GMCS is a fixed sorbent polymer composite applied to sorbent panels housed in modules, which does not require injection of powder sorbents or chemicals, capturing both elemental and oxidized mercury. GMCS may remove sulfur dioxide (SO_2) as a co-benefit. Over time, mercury adsorbs to the sorbent panels until its sorptive capacity has been reached, which then require the modules to be replaced.

The system includes wash equipment to remove particulate material from the pleated sorbent panels. When applied in high SO_2 flue gas environments, the SO_2 converts to sulfuric acid mist which helps to clean the filter/panels and prevent plugging. The panels are housed in modules that may be placed in series to increase the removal efficiency of the system. This technology could be installed downstream of the existing scrubbers as GMCS can operate in saturated gas streams.

Step 2 – Eliminate technologically infeasible options

Activated Carbon Injection (ACI) with the existing scrubbers – ACI prior to the spray tower is not technically feasible. The exhaust temperatures following the kiln range from 1300 °F before the heat recovery steam generator (HRSG) immediately preceding the spray tower (Refer to Figure 2-2 in the Appendix) and 900 °F after the HRSG. ACI before or after the HRSG would be well above the reaction temperatures needed for PAC to effectively adsorb mercury (200 °F – 400 °F, refer to the previous discussion in Step 1 on Activated Carbon Injection ACI) with the existing scrubbers). If the PAC were injected immediately following the HRSG, the PAC would have minimal residence time prior to being captured by the spray tower, further reducing its effectiveness. The kiln off-gas contains other metallic compounds, which would compete with mercury for adsorption and lower the overall control effectiveness. Sorbent injected prior to and captured by the spray tower would be recycled back to the kiln feed. Recycling of the reagent back into the kiln feed will increase the concentration of mercury at steady state entering the spray tower with no means to eliminate the sorbent or captured mercury from the system (besides out the existing stacks). Thus, sorbent injection prior to the spray tower will not remove mercury from the system in the long run. In addition, it could adversely impact quality of the nodules exiting the kiln and thus the electric arc furnaces downstream. Therefore, this option is not technically feasible.

ACI downstream of the spray tower also is not technically feasible for several reasons. As discussed with ACI prior to the spray tower, PAC would compete for adsorption with other metallic compounds and the temperature profile is not appropriate. The exhaust leaving the spray tower is approximately 160 °F and is below the optimal temperature range discussed above for PAC to be effective. In addition, the spray tower exhaust stream is water saturated and contains entrained water droplets. This can blind adsorption sites on the PAC and plug injection lances. In the 2015 Mercury and Air Toxics Standards (MATS) Rule for Phosphoric Acid Manufacturing and Phosphate Fertilizer Production, EPA agreed that ACI is not technically feasible based on concerns with exhaust streams containing entrained water droplets.

Injecting PAC after the spray tower would require the existing scrubbers to accommodate a higher particulate loading. Small and less dense PAC particulates may not be able to be controlled with the design of the existing scrubbers. This could increase particulate emission rates out of the stack and re-emit mercury adsorbed by the PAC, decreasing the overall effectiveness of ACI.

ACI poses significant challenges, as discussed above, and ACI has never been demonstrated on a nodulizing kiln previously. Therefore, ACI with the existing scrubbers is considered to be technologically infeasible and is eliminated from further consideration.

ACI with new polishing baghouses downstream of the existing scrubbers – As discussed previously, ACI downstream of wet pollution control equipment (i.e. the existing scrubbers) can blind adsorption sites on the PAC and plug injection lances. Wet carbon may agglomerate, which could easily plug a downstream fabric filter. In addition, the temperature is below the optimal PAC effectiveness range (200 °F – 400 °F).

Installation of an additional baghouse downstream of a wet pollution control device is not appropriate because water saturated flue gas containing entrained water droplets is very likely to plug the bags.

ACI with a new polishing baghouse downstream of the existing scrubbers poses several technical challenges, with significant process modifications necessary for a full scale installation. Due to the flue gas temperature profile, residence time at the desired reaction temperature, wet flue gas containing water droplets downstream of the spray tower, and the fact that ACI has never been demonstrated in a similar process at full scale, ACI with a new polishing baghouse downstream of the existing scrubbers is considered to be technically infeasible. In addition, in the 2015 MATS Rule for Phosphoric Acid Manufacturing and Phosphate Fertilizer Production, the EPA agreed that ACI is not technically feasible based on concerns with exhaust streams containing entrained water droplets.

Therefore, ACI with new polishing baghouses downstream of the existing scrubbers is considered to be technologically infeasible and is eliminated from further consideration.

Non-carbon sorbent injection - Of the non-carbon sorbents listed (refer to the previous discussion in Step 1 on Non-carbon sorbent injection), none are considered to be technically feasible. Non-carbon sorbents have never been tested on a nodulizing kiln and thus have not been demonstrated in practice that they would be an effective means to reduce mercury emissions. In addition, these sorbents are either not commercially available, displayed contradictory results in other industries, or suffer from the same problems as ACI described previously (refer to the previous discussion in Step 2 on ACI with the existing scrubbers). Sorbent injected prior to and captured by the spray tower would be recycled back to the kiln feed. Recycling of the reagent back into the kiln feed will increase the concentration of mercury at steady state entering the spray tower with no means to eliminate the sorbent or captured mercury from the system (besides out the existing stacks). Thus, sorbent injection prior to the spray tower will not remove mercury from the system in the long run. In addition, it could adversely impact quality of the nodules exiting the kiln and thus the electric arc furnaces downstream.

Therefore, non-carbon sorbent injection is considered to be technologically infeasible and is eliminated from further consideration.

Halide injection - In order to dissociate halides to promote oxidation of mercury, the halide chemical would need to be injected upstream of the spray tower or in the kiln itself where the temperatures promote this reaction. Oxidation of mercury occurs at temperatures ranging from 300 °F to 1000 °F. However, the spray tower quickly quenches the hot exhaust from the kiln below this temperature range or scrubs the halide from the gas stream before it can oxidize mercury. Thus, it is unlikely that halide injection would have sufficient residence time in the desired temperature range to oxidize a significant portion of the mercury for capture in downstream control equipment.

Halide injection also poses a corrosion concern to process equipment. The halide may oxidize plant equipment rather than mercury. There is therefore a potential to accelerate corrosion of plant equipment beyond normal preventative maintenance requirements.

In addition, halides captured by the spray tower have the potential to accumulate in the hydroclarifier water system. Any mercury captured in the spray tower will be recycled to the kiln which will increase the concentration of mercury at steady state entering the spray tower with no means to eliminate the halide chemical or captured mercury from the system (besides out of the existing stacks). Thus, halide injection will not remove mercury from the system in the long run. This may also have adverse production or product quality impacts. In addition, this technology has never been tested on a nodulizing kiln to reduce mercury emission and thus is not sufficiently demonstrated in practice to be a feasible control technology.

Therefore, halide injection is considered to be technologically infeasible and is eliminated from further consideration.

Halide injection with ACI and new polishing baghouses - This technology poses several technical challenges as discussed previously.

Therefore, halide injection with ACI and new polishing baghouses is considered to be technologically infeasible and is eliminated from further consideration.

Fixed-Bed oxidation catalysts - Fixed-bed oxidation catalysts would not be a feasible control technology for the kiln. The only possible location to place the catalyst would be prior to the spray tower because this location within the process contains temperatures that are high enough to facilitate the mercury oxidation reactions. The temperatures following the spray tower are too low to promote oxidation of mercury. However, installing the catalyst bed prior to the spray tower has several issues. Process dust from the kiln would foul the catalyst and/or erode the catalyst surface if particles accumulate on the surface over time. In addition, the presence of SO_2 concentrations is more likely to promote the formation of SO_3, which would inhibit the oxidation of mercury.

Therefore, fixed-bed oxidation catalysts is considered to be technologically infeasible and is eliminated from further consideration.

Fixed carbon beds – Fixed carbon beds are not technically feasible for several reasons. The carbon beds would need to be installed after all existing particulate controls (i.e. the existing wet scrubbers). Therefore, the flue gas would be water saturated and contain entrained water droplets. Similar to ACI this can blind adsorption sites and reduce the carbon's mercury control effectiveness.

The existing wet scrubbers may not achieve low enough filterable particulate concentration prior to the inlet of the beds, which could plug the beds and cause premature shutdowns. Installing enhanced particulate controls (i.e. a baghouse) to avoid particulate plugging downstream of a wet pollution control device is not appropriate because water saturated flue gas is very likely to plug the bags.

In the 2015 MATS Rule for Phosphoric Acid Manufacturing and Phosphate Fertilizer Production, the EPA agreed that fixed carbon beds are not technically feasible based on concerns with exhaust streams containing entrained water droplets.

Therefore, fixed carbon beds are considered to be technologically infeasible and are eliminated from further consideration.

Calomel scrubbers – The previously submitted March 2015 MBACT update summarized several reasons why calomel scrubbers are not technically feasible. As discussed previously (refer to the previous discussion in Step 1 on Calomel scrubbers), this technology has been applied to gold ore roasters such as the Barrick Goldstrike Mine. The flowrates that the Barrick calomel scrubber treats is an order of magnitude lower than the kiln. Calomel scrubbers have not been demonstrated in practice for emission sources with airflows as large as P4's process. The mercury concentrations in the flue gas at Barrick are several orders of magnitude higher than the kiln flue gas. Therefore, the more dilute mercury concentrations from the kiln would greatly increase the size of the scrubber and require much higher amounts of reagent to function properly. Finally, the temperature of the Barrick calomel scrubber operates at temperatures of approximately 105 °F or below. The kiln exhaust stack temperature operates at approximately 150 °F. Thus, installation of a calomel scrubber would require additional flue gas cooling that would result in excessive water vapor condensation and negative impact on plant water balance.

Therefore, calomel scrubbers are considered to be technologically infeasible because of the technical challenges, unresolvable process changes, and the lack of demonstration on emission units similar to P4. Calomel scrubbers and are eliminated from further consideration.

Scrubber additives – Scrubber additives were originally developed to avoid re-emission of mercury captured by wet scrubbers. Mercury reductions from testing in other industries varied greatly but, scrubber additives have not been demonstrated or tested on similar processes compared to the kiln. In addition, it is unknown what impact this technology may have on the water chemistry of the LCDA system or if the additives would accumulate over time.

Therefore, scrubber additives are considered to be technologically infeasible and are eliminated from further consideration.

GMCS – P4 conducted pilot testing of the GMCS technology starting in October 2016 to assess the technical feasibility of a full-scale installation. Pilot testing of GMCS has demonstrated that the GMCS modules reduced mercury emissions from the flue gas stream in a range of approximately 50-90% as demonstrated by Method 30B measurements. Normally, mercury captured by GMCS modules in other industries adheres to the sorbent material, which becomes saturated over time. Once the material is saturated, the module requires replacement (refer to the previous discussion in Step 1 on GMCS). However, after sampling the sorbent material, P4 found that the mercury adsorption on the module was not increasing as expected after four months even though the Method 30B showed no decrease in the mercury capture efficiency across the pilot. P4 then decided to sample the module wash water. This confirmed that the mercury capture is not only occurring by means of the GMCS technology. An alternative mercury control mechanism appears to occur on the surfaces of the mist eliminator and the proprietary sorbent polymer catalyst (SPC) where particulate mercury is formed. This particulate adheres to the surfaces and is subsequently washed off.

Analysis of the wash water indicated that the majority of the mercury in the wash water did not dissolve, but instead adhered to solid particles collected by the GMCS modules. Therefore, treatment, settling, and filtration of the wash water was determined to be an effective means to permanently eliminate the mercury from the system. The existing LCDA system treats, settles, and filters precipitated solids from the process to be disposed of in a double-lined landfill. Therefore, P4 evaluated the possibility of routing the GMCS wash water to the LCDA filtration system to treat, settle, and filter the mercury for final disposal. Pilot testing of a water filtration unit began in March 2018 to determine if this would be an effective means to permanently remove the captured mercury from the wash water.

The pilot study found that filtration could remove greater than 90% of the mercury in the wash water even while varying pH, the GMCS water treatment volume, and the incoming mercury concentration. Therefore, P4 concluded that GMCS could be installed and its wash water purge can be incorporated into the existing LCDA process to control mercury emissions.

Based on pilot testing data, P4 considers GMCS to be technically feasible. However, GMCS has never been tested at full-scale at the P4 facility. Therefore, the mercury reductions listed above are based only on the pilot study data. Therefore, it would not be appropriate at this time to set a mercury emissions target control efficiency for the GMCS as it is unknown how the technology will perform on the full-scale operation. However, once the GMCS technology is installed full-scale on one of the four parallel emission trains, testing will be required to confirm its performance and to determine if it is generally consistent with the pilot study results. After that testing is complete, a mercury emissions target control efficiency requirement can be set with a high degree of confidence in a subsequent permitting action.

Step 3 – Rank remaining options by control effectiveness

The only remaining control technology from Step 2 is GMCS with a mercury control efficiency of 50-90%. Therefore, GMCS with a mercury control efficiency of 50-90%is the highest ranked mercury control technology.

Step 4 – Evaluate technologically feasible control options

Energy - GMCS requires additional electricity to operate wash water sprays and to overcome the pressure drop across the modules with the existing flue gas fans. However, these impacts are considered to be insignificant.

Economic Impacts - Control costs were not evaluated for GMCS because it is the highest ranking technically feasible control technology and P4 has elected to install this technology as MBACT.

Environmental Impacts - GMCS will add small amounts of waste generated from the captured mercury to be disposed of in the facility's double-lined landfill. In addition, the GMCS modules will be replaced once they have reached their mercury loading capacity. Spent modules would need to be disposed of as solid waste. P4 does not consider these impacts to be significant.

Step 5– Select BACT

Therefore, BACT for mercury emissions (MBACT) from the nodulizing kiln at the P4 plant is the use of GMCS with a mercury emissions target control efficiency of 50-90% (to be determined once full-scale operation of the GMCS has commenced along with a shakedown period).

MBACT ANALYSIS APPENDIX A – FIGURES

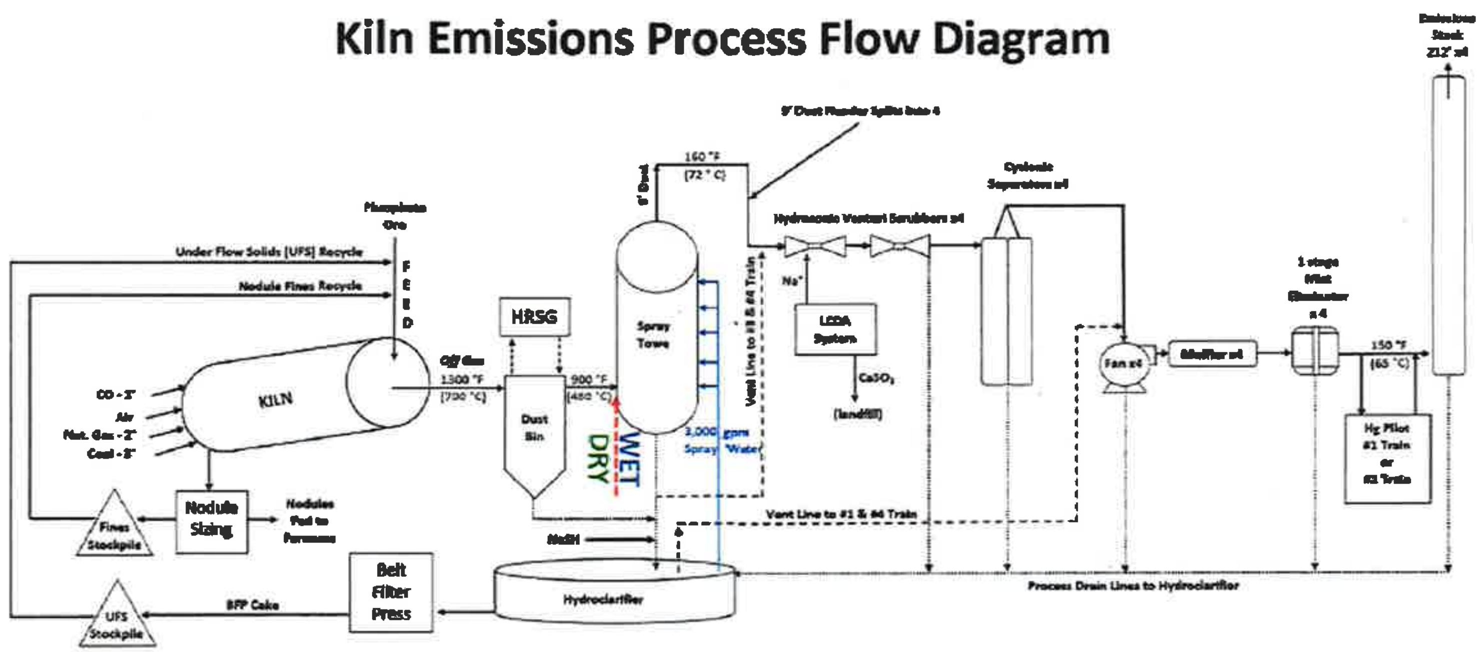

Figure 2-2 Kiln Process Flow Diagram

APPENDIX C – FACILITY DRAFT COMMENTS

The following comments were received from the facility on July 15, 2019:

SOB comments:

Facility Comment: Statement of Basis, Description on pg. 5, modify as follows: "The tapping gasses pass through a high energy venturi scrubber equipped with ~~an entrainment~~ a cyclonic separator before discharge to the atmosphere."

DEQ Response: The requested change will be made to the SOB.

Facility Comment: Statement of Basis, Application Scope on pg. 7, add "A full-scale demonstration of no more than 12-months will be used to determine general consistency with pilot study performance."

DEQ Response: The requested change will be made to the SOB.

Facility Comment: Statement of Basis, Application Scope on pg. 7, modify the third bullet point to read "Provided that a successful full-scale demonstration proves to be generally consistent in terms of performance and reliability with the pilot study, as reviewed and approved by the Agency, the permittee shall complete the installation on the three remaining exhaust streams within five years of permit issuance."

DEQ Response: The requested change will not be made to the SOB because this is a qualifying statement about the effectiveness of the proposed GMCS. If the system does not work as intended, the applicant will need to apply for a new permit for a different scenario than is proposed in the current permit application.

Facility Comment: Statement of Basis, Application Scope on pg. 8, modify the last sentence to read "This permit application is consistent with DEQ's November 20, 2018 Agreement in Principle Regarding Approach to Establishing MBACT Emission Standard response to P4 Production, LLC."

DEQ Response: The requested change will be made to the SOB.

Facility Comment: Statement of Basis, Emissions Units and Control Equipment, Table 1, on pg. 8, add ".. four parallel GMCS collectors."

DEQ Response: The requested change will be made to the SOB.

Facility Comment: Statement of Basis, Emissions Inventories, pgs. 8-10, please remove this section as it has no relevance to the current permit application.

DEQ Response: The Emissions Inventories section will be removed from the SOB as it is not relevant to the current permit application. However, the applicant submitted current mercury emissions inventory will remain in Appendix A of this SOB.

Facility Comment: Statement of Basis, Permit Conditions Review, existing permit condition 1.2 discussion, please add "using a phase construction approach."

DEQ Response: The requested change will be made to the SOB.

Facility Comment: Statement of Basis, Permit Conditions Review, existing permit condition 2.3 discussion, please make the following changes "...~~as to be determined" mercury emissions control efficiency~~ a technology-based standard. This was done due to the current absence of any commercially available control technology capable of reliably controlling mercury emissions from P4's facility, given the operating conditions specific to the kiln (i.e. moisture and temperature, etc.) and the substantial variability in the mercury concentration contained in P4's phosphate ore. ~~because mercury emissions controls are now being proposed to be installed when previously there were none. In addition, as the GMCS has only been operating, as of this permitting action, on a pilot basis. As such, the mercury emissions control efficiency has not yet been determined for the full-scale installation proposed for this project.~~

DEQ Response: The requested change will be made as follows: "… target control efficiency" and "…due to the current absence of any commercially available control technology capable of reliably controlling mercury emissions from P4's facility, given the operating conditions specific to the kiln (i.e. moisture and temperature, etc.) and the substantial variability in the mercury concentration contained in P4's phosphate ore." will be added as this is consistent with the November 20, 2018 Agreement in Principle Regarding Approach to Establishing MBACT Emission Standard response to P4 Production, LLC. As for adding "…a technology-based standard" this will not be added as the definition of MBACT from IDAPA 58.01.01.006 states that it is "An emission standard for mercury based on the maximum degree of reduction practically achievable as specified by the Department on an individual case-by-case basis taking into account energy, economic and environmental impacts, and other relevant impacts specific to the source. As for removing the last part of the statement it will not be removed as it is an accurate statement and no basis for its removal was provided to DEQ staff by the applicant.

Facility Comment: Statement of Basis, Permit Conditions Review, new permit condition 2.9 discussion (now new permit condition 2.10), add "…effective in characterizing the GMCS performance."

DEQ Response: The requested change will be made to the SOB.

Facility Comment: Statement of Basis, Permit Conditions Review, new permit condition 2.10 discussion (now new permit condition 2.11), add a hyphen to "short-term" and add on a "timely" versus "monthly" basis.

DEQ Response: The requested changes will be made to the SOB.

Facility Comment: Statement of Basis, Permit Conditions Review, existing permit condition 2.11 discussion (now new permit condition 2.12), require that the long-term source testing results be submitted to DEQ as required by the General Provisions.

DEQ Response: The requested change will be made to the SOB.

Facility Comment: Statement of Basis, Permit Conditions Review, existing permit condition 2.12 discussion (now new permit condition 2.13), remove "…agreed upon performance standards for the full-scale GMCS installation going forward." and add "if the full-scale demonstration is generally consistent with the pilot study, in terms of performance and reliability."

DEQ Response: The requested change will not be made to the SOB as the interim report will be required to be submitted to DEQ whether the full-scale testing results match the pilot study results or not. However, "mercury emissions target control efficiency" will be added in place of "performance standards" so that this language is consistent throughout the permit and SOB.

Facility Comment: Statement of Basis, Permit Conditions Review, existing permit condition 2.13 discussion (now new permit condition 2.14), add "target" to control efficiency.

DEQ Response: The requested change will be made, as was done throughout the permit and SOB, as "target control efficiency" is consistent with the November 20, 2018 Agreement in Principle Regarding Approach to Establishing MBACT Emission Standard response to P4 Production, LLC.

Permit comments:

Facility Comment: Permit Condition 1.1, Purpose, please add "treatment" and "...for blowdown from" to this permit condition.

DEQ Response: The requested changes will be made to this permit condition.

Facility Comment: Permit Condition 1.2, Purpose, please add "A full-scale demonstration of no more than 12-months will be used to determine general consistency with pilot study performance."

DEQ Response: The requested change will be made to this permit condition.

Facility Comment: Permit Condition 1.2, Purpose, please remove "Within three years of permit issuance the permittee shall complete the installation and operation on the three remaining exhaust streams" and add "Provided that a full-scale demonstration proves to be generally consistent in terms of performance and reliability with the pilot study, as reviewed and approved by the Agency, the permittee shall complete the installation on the three remaining exhaust streams within five years of permit issuance." "What about the demonstration? There should be some requirement for review and approval to proceed, based on determination of general consistency with Pilot."

DEQ Response: Permit Condition 1.2 will be changed as requested to require the GMCS be installed within five years instead of three. As for adding a qualifying statement about the effectiveness of the proposed GMCS this will not be done. This is because if the GMCS system does not work as intended, the applicant will need to apply for a new permit for a different scenario than is proposed in the current permit application.

Facility Comment: Regulated Sources, Table 1.1, on pg. 3, please add "...four parallel GMCS collectors."

DEQ Response: The requested change will be made to this permit condition.

Facility Comment: Permit Condition 2.1, Process Description, please alter this condition as follows: "The nodulizing kiln's exhaust gas is routed through an emission control system ~~that includes a dust knockout chamber for large particulate removal, a spray tower used to capture soluble gases and fine particulate matter, four parallel hydrosonic scrubbing systems that remove submicron dust particles and entrained particulate and sulfur-laden water, and then the GMCS~~ prior to exhausting out of the four <u>65m</u> ~~tall~~ stacks. ~~The nodule cooling process generates both point and fugitive particulate matter that is controlled by a wet scrubbing system.~~"

DEQ Response: The requested changes will be made to this permit condition.

Facility Comment: Permit Condition 2.2, Control Device Descriptions, please add "P4's phosphate ore nodulizing kiln is regulated for particulate matter, radionuclides, SO_2, and mercury emissions. The cooler spray tower controls particulate matter and SO_2 emissions from the nodule cooler at the discharge end of the kiln. The kiln flue gas passes through a dust knockout chamber followed by a North spray tower. The flue gas is then split into four separate streams, each treated by a Hydro-Sonic venturi scrubber, a pair of parallel cyclonic separators, primary and secondary mist eliminators, and GMCS collectors before exiting through a stack. The lime concentrated dual alkali (LCDA) scrubbing process removes SO_2 and fine particulate matter in the Hydro-Sonic scrubbers. The scrubbing solution from the Hydro-Sonic scrubbers, made up of sodium sulfite/bisulfite/sulfate, is continuously pumped to a dual-reactor system where it is reacted with hydrated lime to precipitate calcium sulfite/sulfate solids. The solids are removed from the system through thickening and filtration, and the reclaimed solution is returned to the scrubber. The LCDA installation includes raw material storage tanks, three reactor tanks, thickener/clarifier, filtration (feed tank with vacuum filtering process), and a double-lined landfill with leachate collection. The flue gas passes through the GMCS collectors prior to exiting the stack, with mercury being collected from the flue gas by GMCS proprietary sorbent polymer catalyst (SPC) material in each of the GMCS modules. GMCS water blowdown is sent along with the Hydrosonic scrubber solution for treatment in the LCDA scrubbing process. Each collector is constructed with a minimum of a 6x6 array of GMCS modules, stacked four modules high, for a total of at least 144 modules per kiln emission train with a total of at least 576 modules all across all four kiln emission trains."

DEQ Response: This is a description of the emissions controls employed at the facility that would only be made enforceable by specific requirements listed in the permit. Therefore, the description of the emissions controls employed at the facility language will instead be added to the Facility Information – Description section of the SOB.

Facility Comment: Permit Condition 2.1, Table 2.1, Nodulizing Kiln Description, please add "four parallel" and "collectors" to the control devices description.

DEQ Response: The requested changes will be made to this permit condition.

Facility Comment: Permit Condition 2.3, Mercury Emissions Target Control Efficiency, please add "Due to the current absence of any commercially available control technology capable of reliably controlling mercury emissions from P4's facility, given the operating conditions specific to the kiln and the substantial variability in the mercury concentration contained in P4's phosphate ore, design, equipment, work practice, and operational standards are and will be established to meet an approved MBACT standard."

DEQ Response: This is a qualifying statement about mercury control technology that serves no purpose in a permit requirement. Therefore, the requested change will not be made to the permit condition.

Facility Comment: Permit Condition 2.3, Mercury Emissions Target Control Efficiency, please add "target" (multiple times) and add "based on pilot plant performance."

DEQ Response: The words "target control efficiency" will be added as requested. As for adding based on pilot plant performance the permit already specifies that the installation on the initial stack will serve to set the requirements for the remaining three stacks so no change to permit is required.

Facility Comment: Permit Condition 2.4, North Spray Tower (Nodulizing Kiln Spray Tower) Operation: "Given the fact that we know the speciation to be mostly elemental; therefore, North Spray Tower water spray tower flowrate would be more relevant to particulate vs. mercury. If it must stay, the Tier 1 permit uses more general language, such as "that is verified through source testing to not exceed the hourly emission limits established", hence my suggested edits."

DEQ Response: There was no proposed change to this permit condition as it was a previous requirement on the North Spray Tower that it is not being modified as a result of this project. Therefore, the requested change will not be made to the permit condition.

Facility Comment: Permit Condition 2.5, GMCS Operational Requirements: "Due to the problematic nature of maintaining a flowmeter for velocity measurement, pressure drop measurement is much easier and sustainable. Gas velocity would continue to be measured and reported as part of any Ontario Hydro testing. This should not be here, but will be part of the O&M action plan, as necessary in the hierarchy of actions."

DEQ Response: The permit condition will be modified to include the face velocity, pressure drop, and mercury emissions target control efficiency and remove the face velocity through the GMCS modules.

Facility Comment: Permit Condition 2.6, North Spray Tower (Nodulizing Kiln Spray Tower) Monitoring Requirement, please add "...three-hour average..."

DEQ Response: As discussed previously there was no proposed change to this permit condition as it was a previous requirement on the North Spray Tower that it is not being modified as a result of this project and there was no explanation as to why this permit condition should be modified. Therefore, the requested change will not be made to the permit condition.

Facility Comment: Permit Condition 2.7, GMCS Monitoring Requirement, please change the face velocity requirement to a pressure drop requirement.

DEQ Response: The requested change will be made to this permit condition.

Facility Comment: Permit Condition 2.8 (was part of 2.7), GMCS O & M Plan Submittal Requirement, please require that the O & M plan be submitted within 180 days, change the face velocity to pressure drop across the GMCS collectors, and require annual uptake of mercury into the modules. "Pressure drop across the control equipment is more preferred alternative to measuring gas velocity. The plant has extensive experience monitoring pressure drop, and that parameter falls in line with similar requirements on other emission control equipment in the Tier I permit. A correlation can be developed between pressure drop and flowrate, to determine superficial face velocity. The LCDA process is already monitored and controlled in the Tier I permit, and GMCS blowdown will not change that."

DEQ Response: The requested changes will be made to this permit condition.

Facility Comment: Permit Condition 2.9 (was permit 2.8), Short-Term Mercury Testing Requirement, please require monthly mercury testing that then goes to quarterly mercury testing after 12 months, test for concentration not pounds, remove the face velocity requirement, include pressure drop, remove the mercury loading, and remove the redundant mercury control efficiency.

DEQ Response: The requested changes will be made to the permit condition with one exception. Short-term mercury testing will still be required monthly as this was a compromise in lieu of a mercury CEMS as was operated during the pilot study. Because a CEMS was no longer required, ongoing monthly testing is reasonable for the applicant to perform.

Facility Comment: Permit Condition 2.10 (was permit condition 2.9), Long-Term Mercury Testing Requirement, please add "Within", remove ""all four different installations", change the face velocity requirement, include pressure drop, remove the mercury loading, and specify the mercury control efficiency using Method 30B. This last request is because the Ontario Hydro method is extremely hard to do in a horizontal duct, which is what we have on the Inlet. If control efficiency is desired during the annual test, then the Ontario Hydro test should be coupled with a 30B test for that measurement.

DEQ Response: The requested changes will be made to this permit condition.

Facility Comment: Permit Condition 2.11 (was permit condition 2.10), Short-Term Mercury Testing Reporting Requirement, please remove "on a monthly basis."

DEQ Response: The requested change will be made to this permit condition.

Facility Comment: Permit Condition 2.13 (was permit condition 2.12), Interim GMCS Reporting Requirement, please add "and reliability", "to establish a comparison of general consistency", and add a requirement that DEQ respond within 30 days of the report submittal.

DEQ Response: The first two requested additions add qualifiers to the report that are unnecessary as they would be included in the report from P4 anyways. The third request to place a 30-day deadline on DEQ to respond to the report is not a typical permit requirement. Therefore, the requested changes will not be made to this permit condition.

Facility Comment: Permit Condition 2.14 (was permit condition 2.13), Final GMCS Reporting Requirement, "This language is in sharp contrast to what was discussed and agreed to by DEQ in the November 20, 2018 letter. It seems to ignore the significant basis for a technology-based standard (unique operating conditions of the kiln off-gas, and high variability of mercury concentration in phosphate ore) and pushes for a control efficiency limit vs. a target requirement agreed upon." In addition, please remove the requirement to submit a permit revision/renewal application.

DEQ Response: The words "mercury emissions target control efficiency" will be added to the permit condition to make this permit condition consistent with the November 20, 2018 Agreement in Principle Regarding Approach to Establishing MBACT Emission Standard response to P4 Production, LLC. The requirement to submit a permit revision/renewal application will also be removed as the proposed project will take the entire five year permit term to complete thus this requirement will be taken care by the expiration of the permit.

MBACT comments:

Facility Comment: Top Down MBACT Analysis, pg. 1, last paragraph, please add "an entrainment" and remove "cyclonic."

DEQ Response: The requested change will be made to the MBACT analysis.

Facility Comment: Top Down MBACT Analysis, pg. 9, second paragraph, please add "greater than" and remove "approximately."

DEQ Response: The requested change will be made to the MBACT analysis.

Facility Comment: Top Down MBACT Analysis, pg. 9, third paragraph, modify as follows: "Based on pilot testing data, P4 considers GMCS to be technically feasible. However, GMCS has never been tested at full-scale at the P4 facility. Therefore, ~~the mercury reductions listed above are based only on the pilot study data. Therefore, it would not be appropriate at this time to set a mercury control efficiency for GMCS as it is unknown how the technology will perform at full-scale operation. However, once~~ the GMCS technology ~~is~~ will be installed full-scale on one of the four parallel emission trains testing will be required to confirm its performance and to determine if it is generally consistent with the pilot study results. ~~After which time a mercury control target efficiency requirement can be set with a high degree of confidence in a subsequent permitting action.~~ "This language is in sharp contrast to what was discussed and agreed to by DEQ in the November 20, 2018 letter. It seems to ignore the significant basis for a technology based standard (unique operating conditions of the kiln off-gas, and high variability of mercury concentration in phosphate ore) and pushes for a control efficiency limit vs. a target requirement agreed upon."

DEQ Response: The words "mercury emissions target control efficiency" will be added to the MBACT analysis to make it consistent with the November 20, 2018 Agreement in Principle Regarding Approach to Establishing MBACT Emission Standard response to P4 Production, LLC.

Facility Comment: Top Down MBACT Analysis, pg. 9, BACT Selection paragraph, modify as follows: "Therefore, BACT for mercury emissions (MBACT) from the nodulizing kiln at the P4 plant is the use of GMCS, assuming general consistency with the pilot evaluation ~~with a mercury control efficiency of 50-90% (to be determined once full-scale operation of the GMCS has commenced along with a shakedown period).~~"

DEQ Response: Based upon the pilot study performance, MBACT was determined to be GMCS with a control efficiency of 50-90% as this control efficiency was used to rank and determine "An emission standard for mercury based on the maximum degree of reduction practically achievable." Therefore, the requested changes will not be made to the MBACT analysis.

APPENDIX D – PROCESSING FEE

T2 Processing Fee Calculation Worksheet

Instructions:
Insert the following information and answer the following questions either Y or N. Insert the permitted emissions in tons per year into the table. TAPS only apply when the Tier II is being used for New Source Review.

Company:	**P4 Production**
Address:	**1853 Hwy. 34 North**
City:	**Soda Springs**
State:	**ID**
Zip Code:	**83276**
Facility Contact:	**Jim McCulloch**
Title:	
AIRS No.:	**029-00001**

N	Did this permit meet the requirements of IDAPA 58.01.01.407.02 for a fee exemption Y/N?
N	Does this facility qualify for a general permit (i.e. concrete batch plant, hot-mix asphalt plant)? Y/N
N	Is this a synthetic minor permit? Y/N

Emissions Inventory	
Pollutant	Permitted Emissions (T/yr)
NO_X	0.0
PM10	0.0
PM	0.0
SO_2	0.0
CO	0.0
VOC	0.0
Total:	0.0
Fee Due	**$ 1,250.00**

Comments: